US008551234B2

(12) **United States Patent**
Kim et al.

(10) **Patent No.: US 8,551,234 B2**
(45) **Date of Patent: Oct. 8, 2013**

(54) **AIR CLEANER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 610 days.

(21) Appl. No.: **12/672,543**

(22) PCT Filed: **Aug. 7, 2008**

(86) PCT No.: **PCT/KR2008/004580**

§ 371 (c)(1),
(2), (4) Date: **Nov. 22, 2010**

(87) PCT Pub. No.: **WO2009/020354**

PCT Pub. Date: **Feb. 12, 2009**

(65) **Prior Publication Data**

US 2011/0056380 A1 Mar. 10, 2011

(30) **Foreign Application Priority Data**

Aug. 8, 2007 (KR) 10-2007-0079680
Sep. 20, 2007 (KR) 10-2007-0096111

(51) **Int. Cl.**
B01D 46/46 (2006.01)

(52) **U.S. Cl.**
USPC ..... **96/417**; 55/357; 55/471; 55/DIG. 34; 74/10 R; 200/11 R; 200/564; 200/566; 200/336

(58) **Field of Classification Search**
USPC ..... 96/244, 417–423; 55/393, DIG. 34
See application file for complete search history.

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(57) **ABSTRACT**

An air cleaner having a manipulator is disclosed. The manipulator (**200**) includes a rotary manipulation unit (**300**), which is provided so as to be movable between a first position, at which the rotary manipulation unit is retracted into the air cleaner, and a second position, to which the rotary manipulation unit is extracted from the air cleaner to enable a user to manipulate the rotary manipulation unit. The manipulator further includes a lift unit (**400**), which is installed in the air cleaner to move the rotary manipulation unit between the first position and the second position. In the present invention, the manipulator can control several functions of the air cleaner obviating the need for having several control buttons, thus being more convenient for a user. Furthermore, the present invention can prevent water from permeating a PCB mounted in the rotary manipulation unit, thus preventing malfunction of the encoder unit.

19 Claims, 9 Drawing Sheets

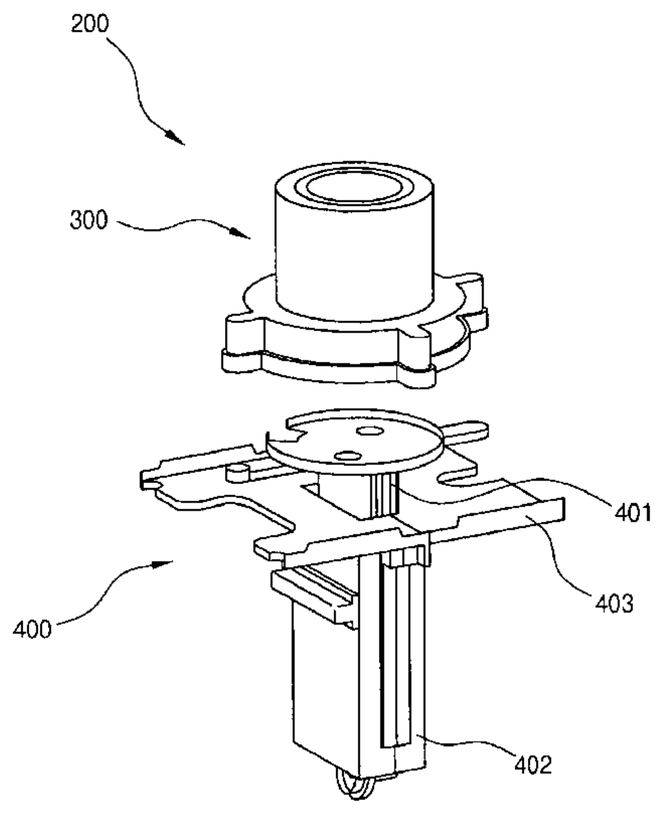

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Fig. 1

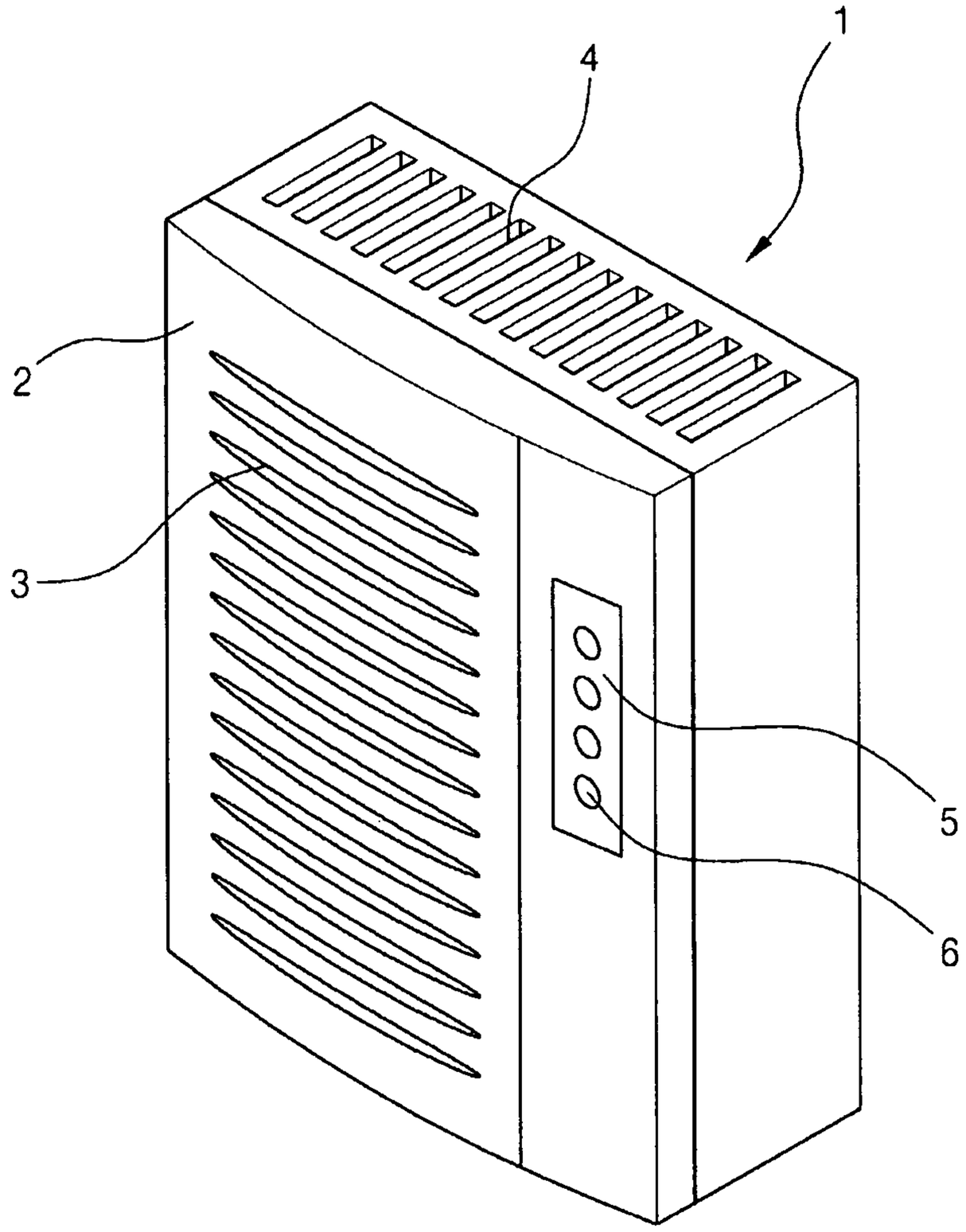
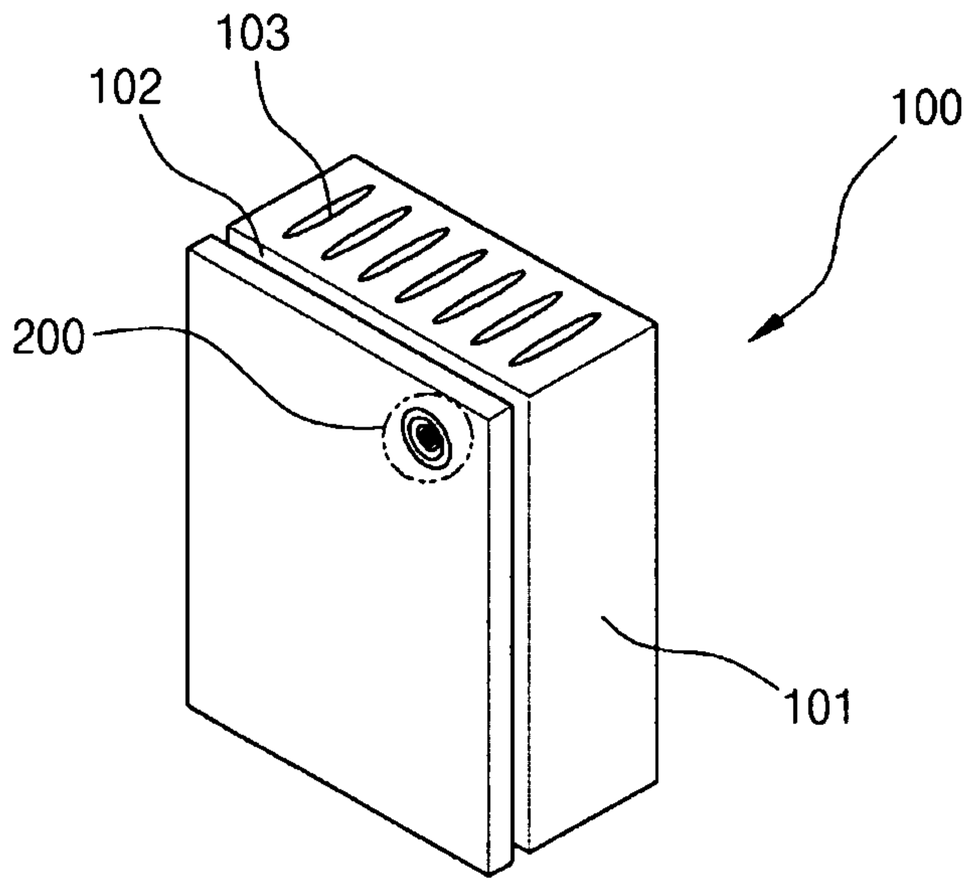


Fig. 2



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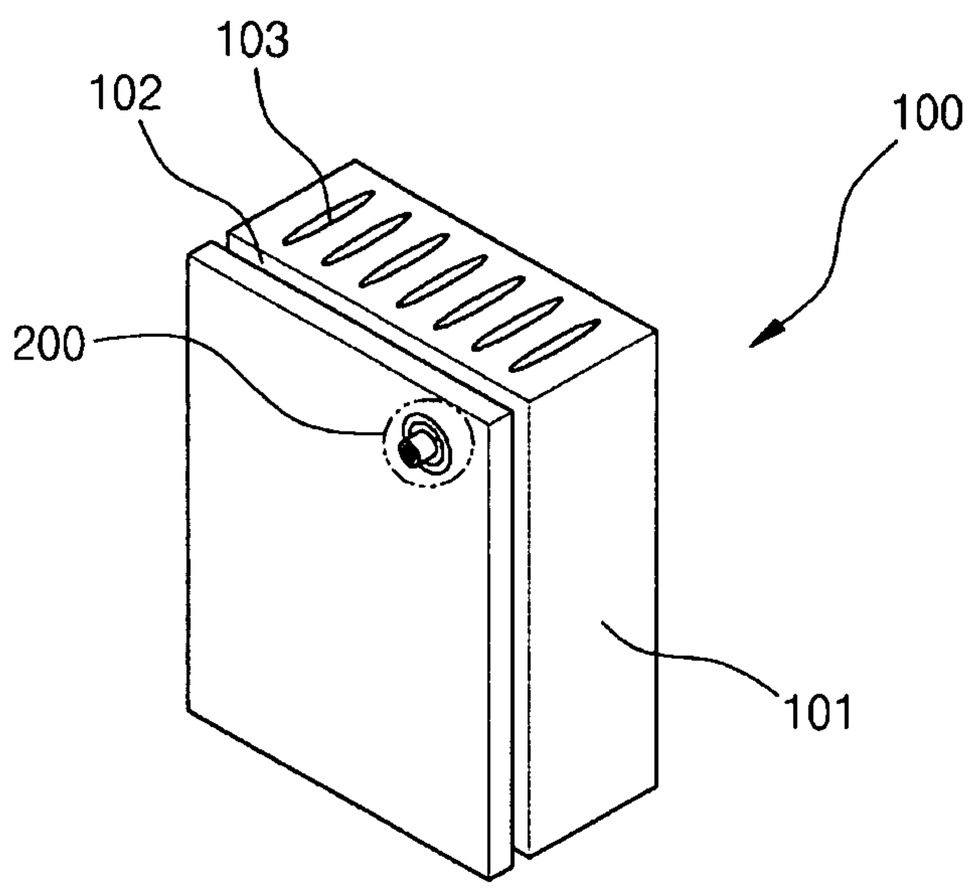

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Fig. 3

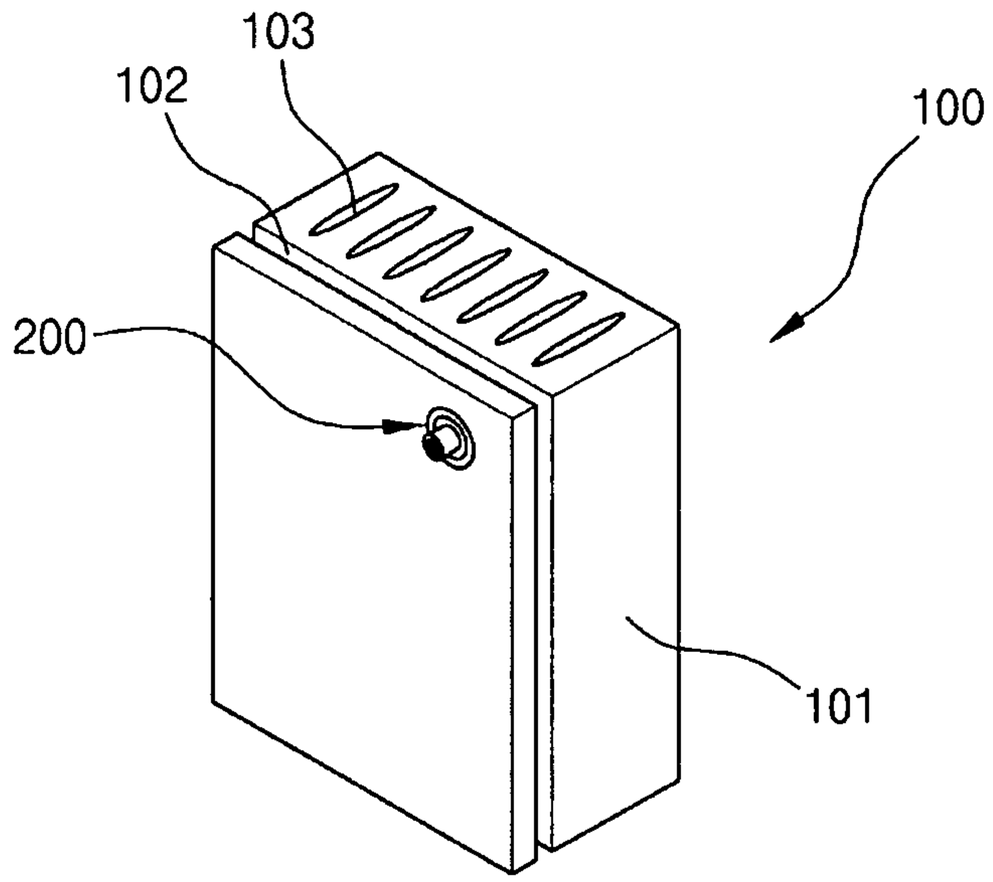


Fig. 4

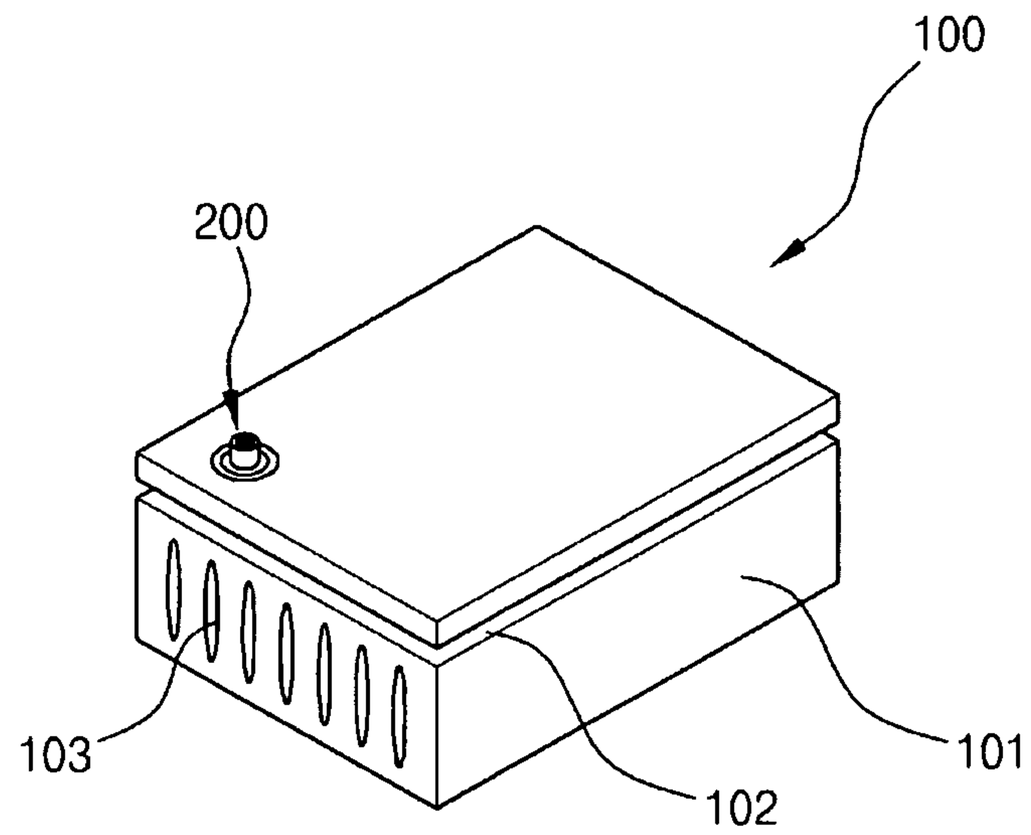


Fig. 5

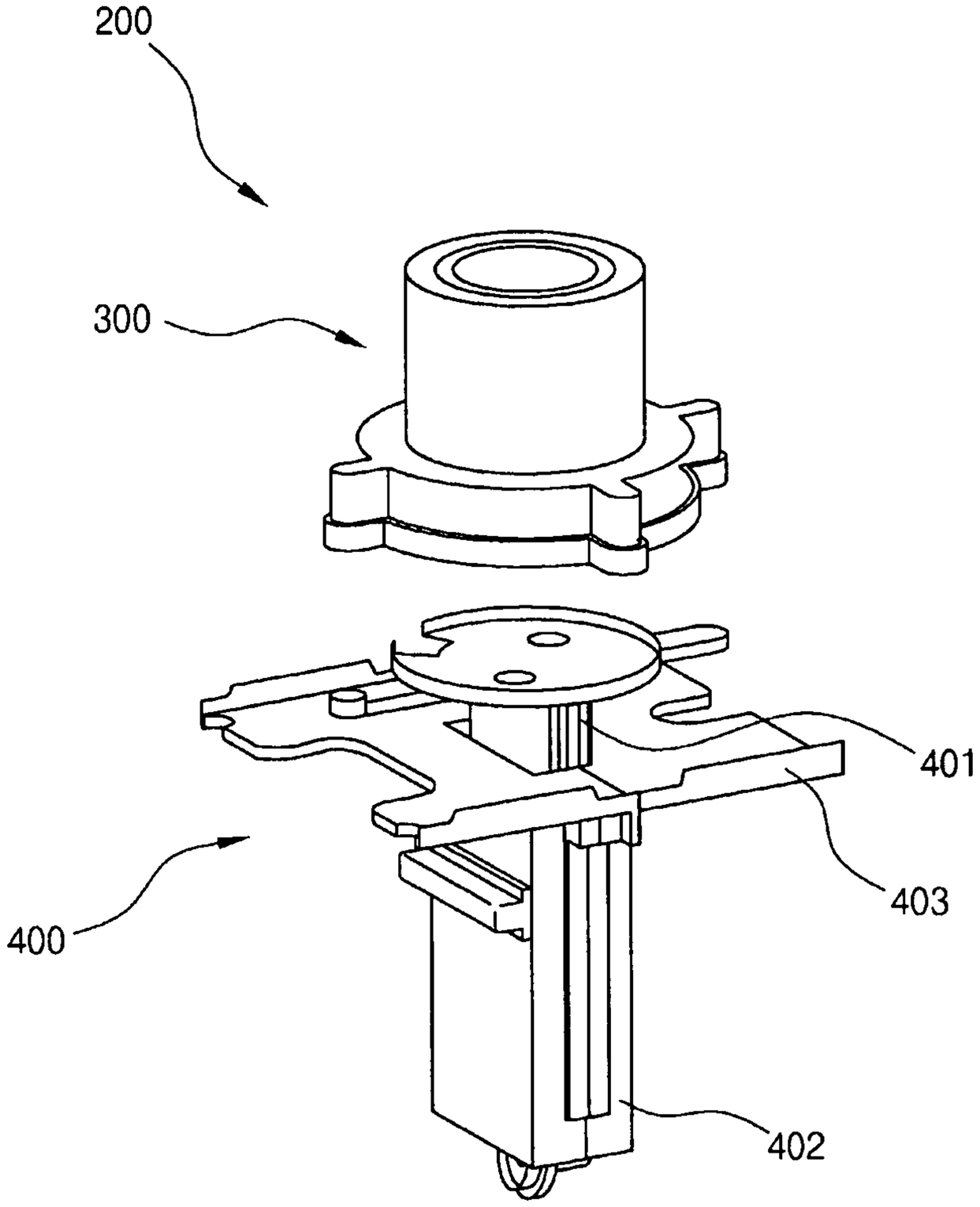


Fig. 6

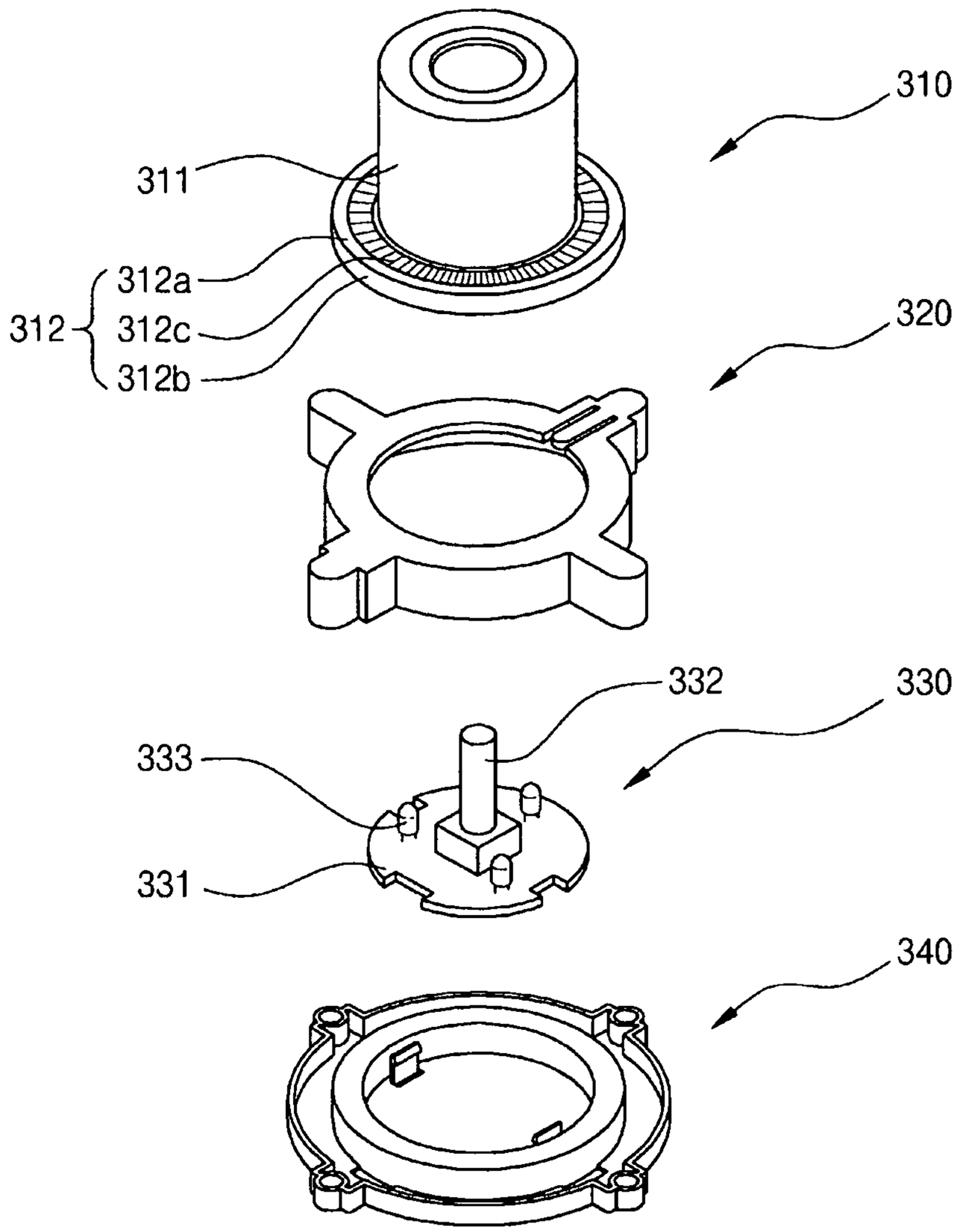
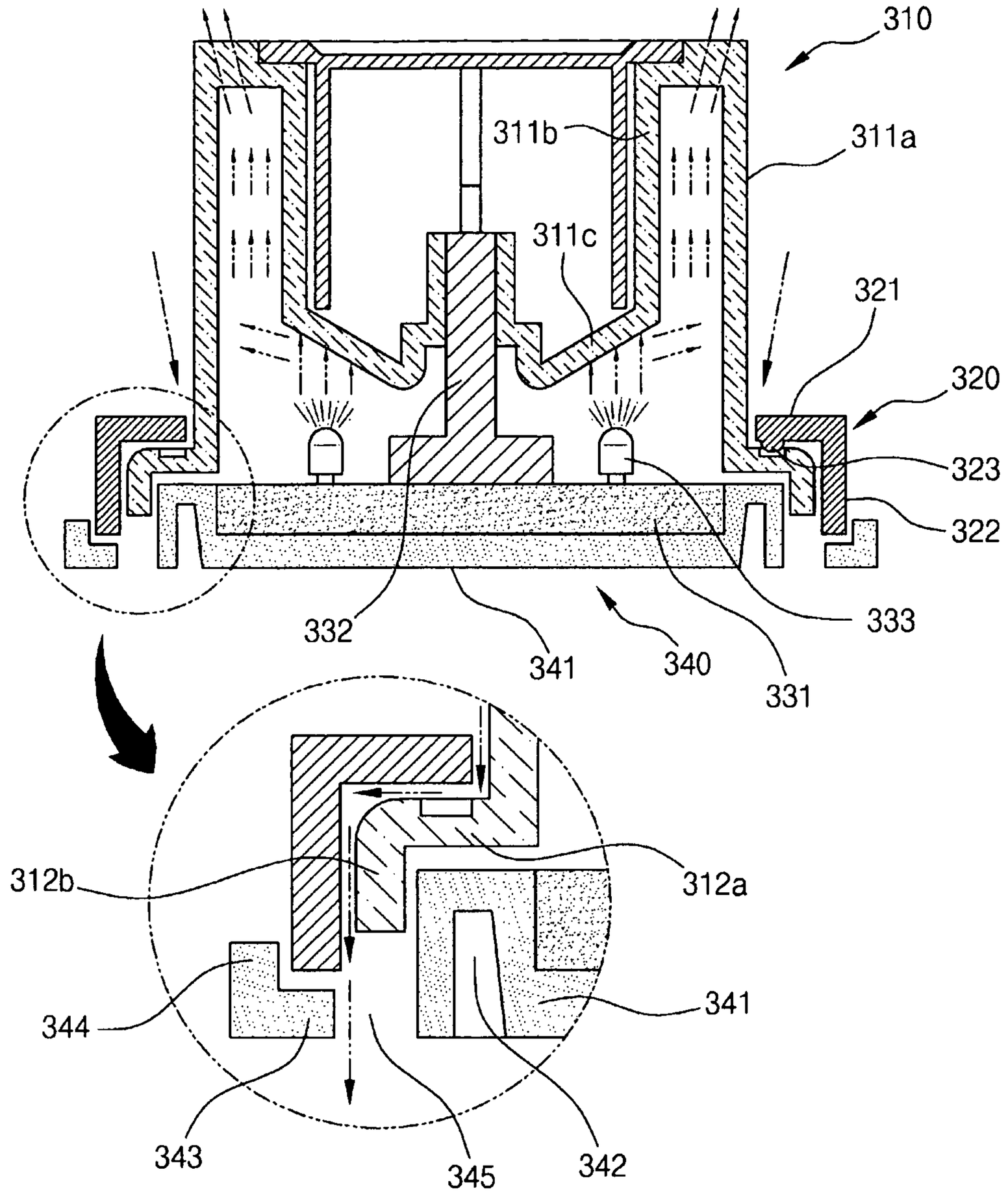


Fig. 7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311b
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Fig. 8

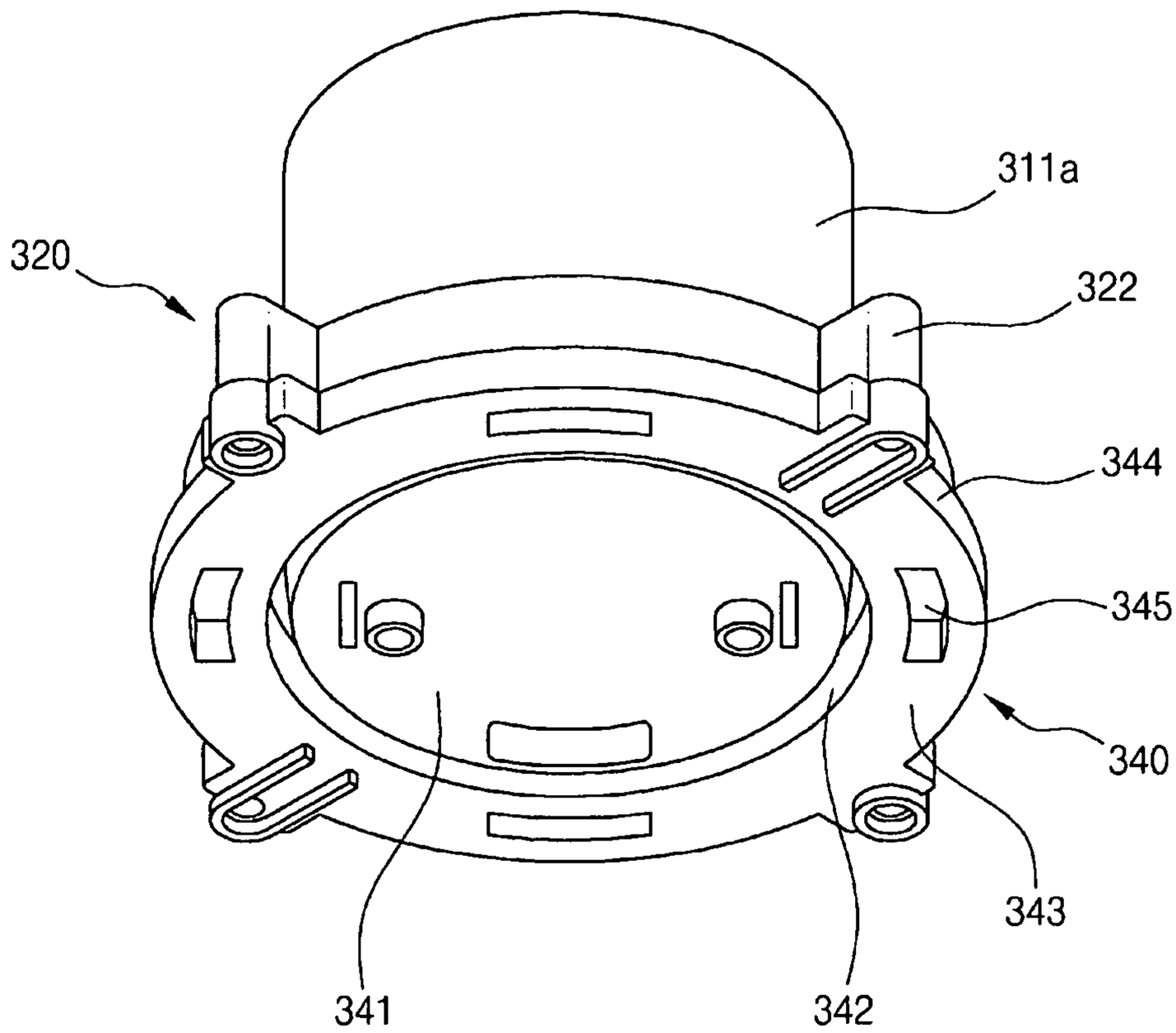


Fig. 9

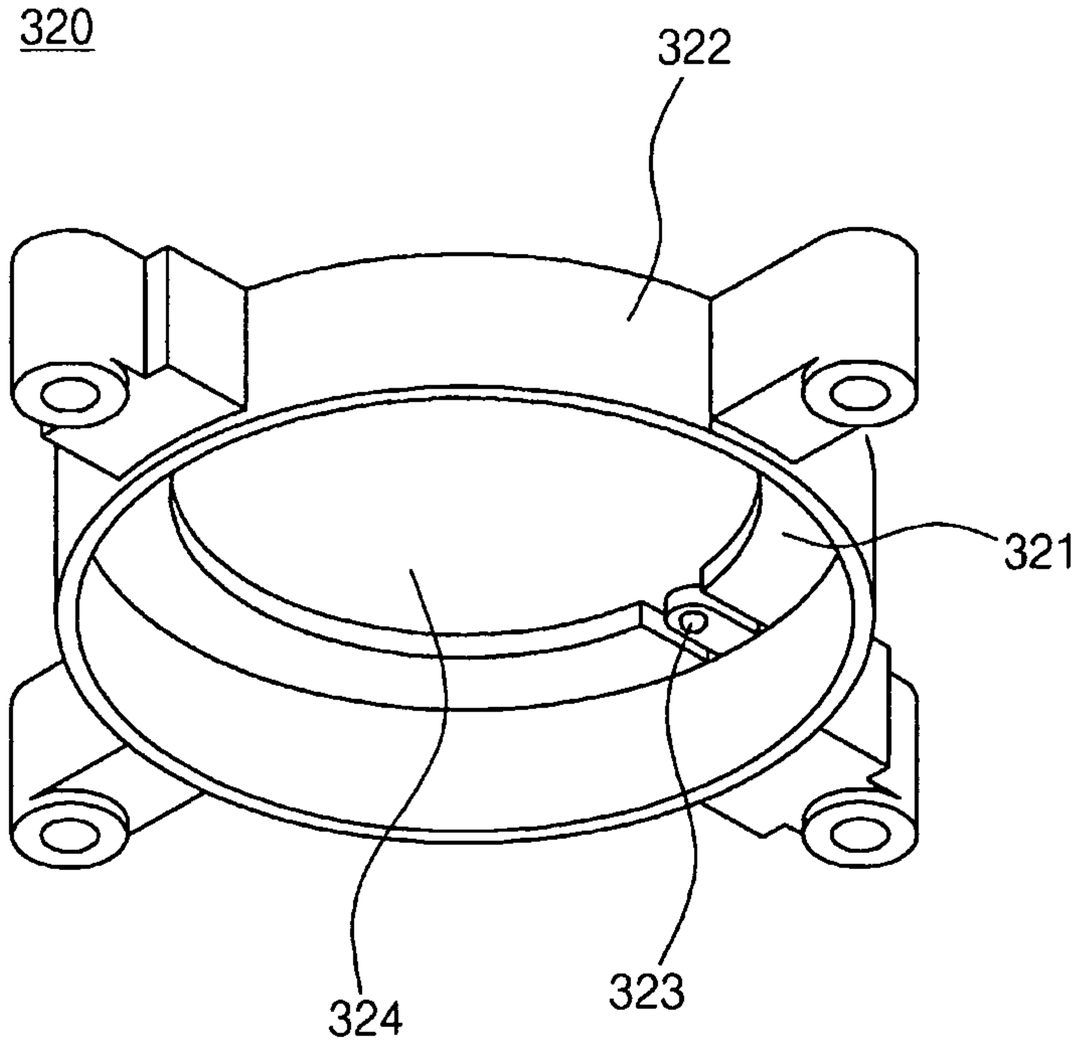


Fig. 10

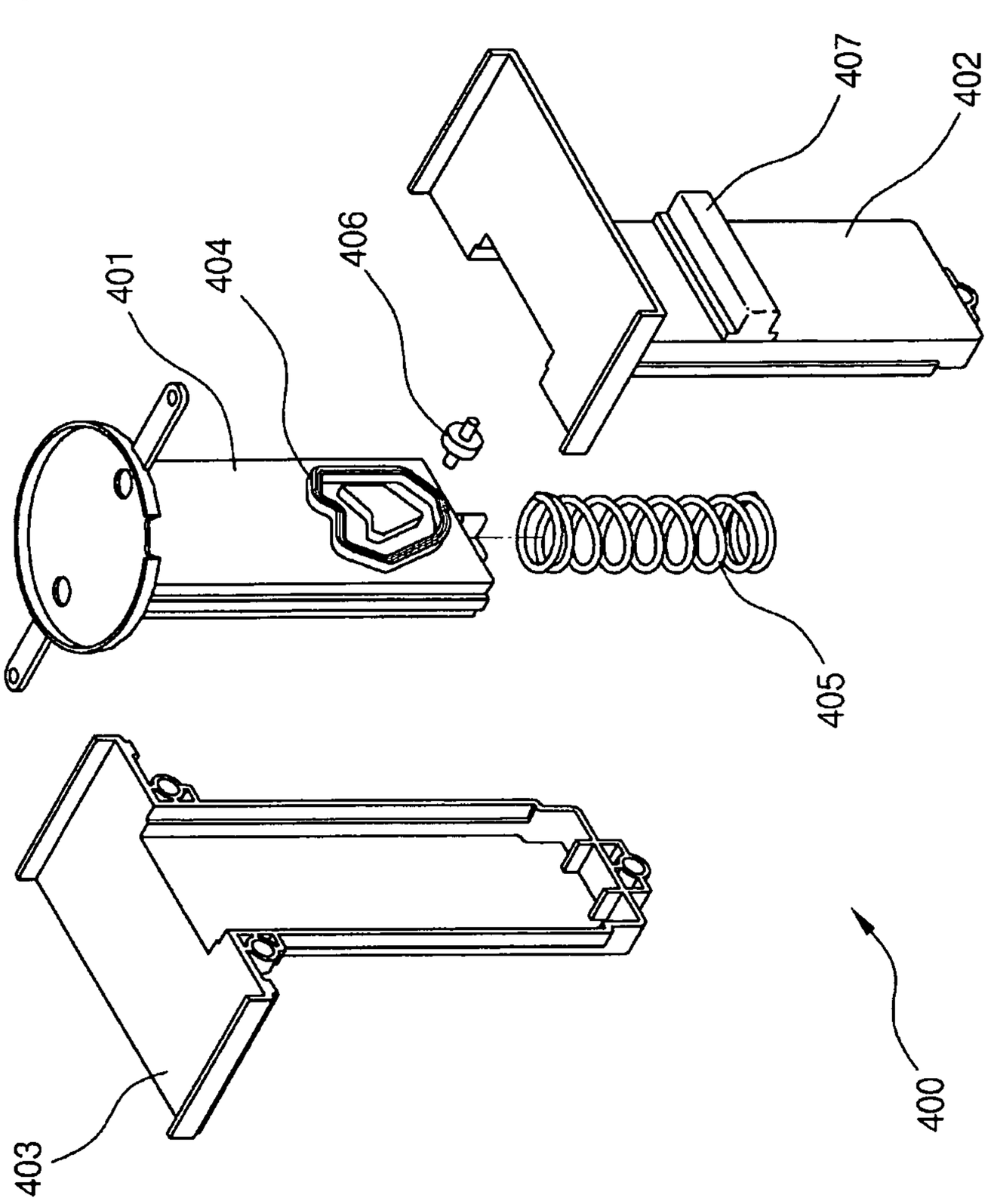
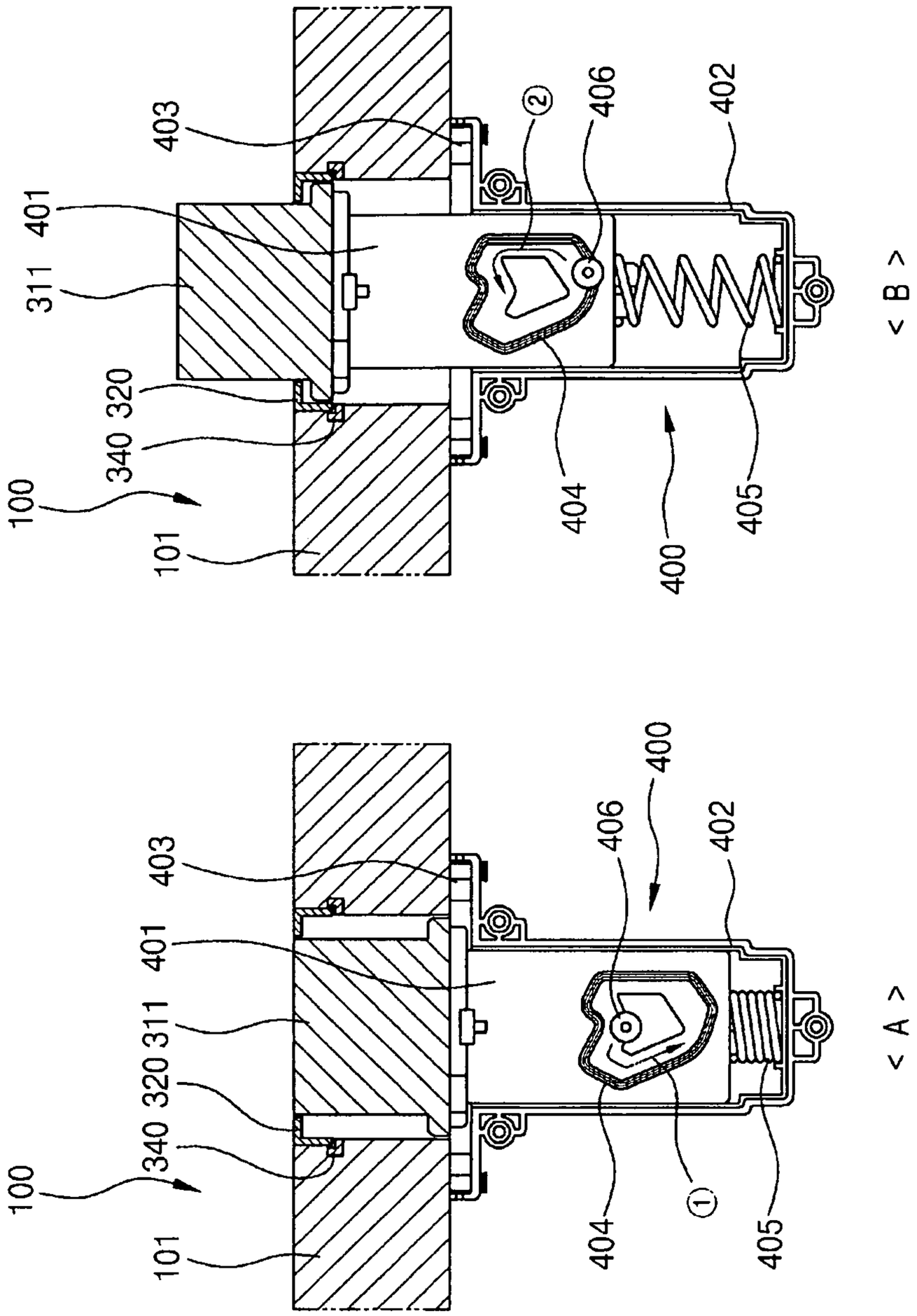


Fig. 11



AIR CLEANER

This application is a U.S. National Application of PCT International Application No. PCT/KR2008/004580, filed Aug. 7, 2008.

TECHNICAL FIELD

The present invention relates, in general, to air cleaners and, more particularly, to an air cleaner which has a rotary manipulator, which is retractably extracted from the outer surface of the air cleaner and is able to prevent water from being undesirably drawn therethrough and into the air cleaner.

BACKGROUND OF THE INVENTION

As is well known to those skilled in the art, air cleaners are apparatuses which purify polluted air to change it into clean air. Typically, an air cleaner is installed in a room having a predetermined volume and functions to remove pollution substances and harmful bacteria from the air in the room and thus provide clean air.

According to the purification method used, such air cleaners are classified into filter type air cleaners, electrostatic precipitation air cleaners and anion generating air cleaners. The filter type air cleaners typically include several filters, such as a free filter (or a medium filter) for removing large particles, a HEPA filter for removing fine particles, and an active carbon filter for removing noxious gas and odor. Recently, in particular, water filters which remove pollution, such as dust or particulates, using the absorptive force of water, are also widely used. The electrostatic precipitation air cleaners collect dust and remove odors using a high voltage. The electrostatic precipitation air cleaners can effectively remove fine particles of dust as well as large particles of dust, thus creating a superior air cleaning effect. However, after a predetermined amount of dust is collected, dust may become undesirably separated from a dust collection plate. Therefore, the dust collection plate must be frequently cleaned and maintained. The anion generating air cleaners make use of the property of anions to bond noxious substances floating in the air.

Meanwhile, according to the installed orientation, air cleaners are classified into stand type air cleaners and table type air cleaners. The stand type air cleaners are placed upright on the ground. The table type air cleaners are horizontally placed on the ground such that covers disposed on the upper surfaces of the air cleaners can be used as tables.

FIG. **1** is a view showing the external shape of a typical air cleaner. As shown in FIG. **1**, the conventional air cleaner **1** includes a casing **2**, which has a predetermined shape (typically, a rectangular parallelepiped shape). An inlet port **3** and an outlet port **4** are formed in the casing **2**.

Furthermore, a fan (not shown) is typically installed in the casing **2** of the air cleaner **1**. Air in a room is drawn into the casing **2** through the inlet port **3** by the operation of the fan (not shown). Thereafter, noxious substances are removed from air using one of the above-mentioned air cleaning methods. Cleaned air is subsequently discharged from the air cleaner **1** through the outlet port **4**.

A manipulator **5** is provided on the casing **2** of the air cleaner **1** to manipulate and control the operation of the air cleaner **1**.

In detail, the operations of turning on/off the air cleaner **1**, cleaning intensity, cleaning operation duration, an air discharge direction, or a cleaning mode such as a sandy dust removing mode, a dehumidifying mode, a humidifying mode, are controlled using the manipulator **5**.

However, the manipulator **5** of the conventional air cleaner **1** includes control buttons **6**. To control the several functions of the air cleaner **1**, the several control buttons **6** corresponding to the number of functions of the air cleaner **1** is required.

In particular, recently, as well as having the basic air cleaning function, the air cleaners are manufactured with a tendency to be able to conduct various air cleaning functions depending on conditions in rooms. Therefore, in response to this, the number of control buttons **6** must concomitantly be increased. In this case, the manipulator **5** occupies a relatively large area of the outer surface of the air cleaner **1**, thus deteriorating the external appearance of the air cleaner **1**.

In addition, when it is desired for a user to control the functions of the air cleaner **1**, the user must check all control buttons **6** corresponding to the respective functions and thereafter push the desired button or buttons.

Moreover, with regard to an air cleaner which has an encoder unit and is convertible between a table type and a stand type, in the case where the air cleaner is used in the table type manner, the encoder unit may inconvenience the user, because the encoder unit protrudes from the outer surface of the air cleaner to allow the user to hold and rotate the encoder unit. As well, there is a problem in that water may enter the encoder unit, with the result that a printed circuit board (hereinafter, referred to in common as 'PCB') of the encoder unit is damaged by water. That is, in the case where the air cleaner is used in the table type manner, the cover provided on the upper surface of the air cleaner forms the upper surface of the table. Because the encoder unit is typically provided in the cover that forms the upper surface of the table, water may permeate the encoder unit. As a result, the PCB of the encoder unit may be damaged.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an aspect of the present invention is to provide an air cleaner which has a rotary manipulator in place of the conventional button type manipulators, thus improving the external appearance of the air cleaner, and facilitating the manipulation of the manipulator, wherein water is prevented from being drawn into the air cleaner through the rotary manipulator by virtue of its construction.

In an aspect, the present invention provides an air cleaner having a manipulator, wherein the manipulator includes: a rotary manipulation unit provided so as to be movable between a first position, at which the rotary manipulation unit is retracted into a casing of the air cleaner, and a second position, at which the rotary manipulation unit is extracted from the casing of the air cleaner to enable a user to manipulate the rotary manipulation unit, wherein when the rotary manipulation unit is disposed at the second position, the rotary manipulation unit is allowed to be rotated by the manipulation of the user to control operation of the air cleaner; and a lift unit supportably installed in the air cleaner to move the rotary manipulation unit between the first position and the second position.

The rotary manipulation unit may include: a handle, having a knob and an extension part extending from a lower end of the knob in a circumferential direction; an upper cover for supporting the extension part of the handle to prevent the handle from being removed from a correct position thereof; a lower cover for covering a lower surface of the upper cover; and a control signal generator mounted to the lower cover to

generate various control signals corresponding to the rotation of the handle for controlling the air cleaner.

The control signal generator may include: an encoder mounted to a PCB and connected to a rotating center of the handle to generate different control signals depending on angles at which the handle is rotated to; and at least one luminous unit to generate various colors of light.

The extension part of the handle may include: a first extension extending outwards from an outer surface of the knob in a horizontal direction; and a second extension extending from an outer edge of the first extension in a vertical direction, wherein the second extension may be inserted between the upper cover and an annular protrusion part, which protrudes from a perimeter of the lower cover in a vertical direction.

The lower cover may include: a first support part, on which the control signal generator is seated; the annular protrusion part protruding upright from an outer edge of the first support part; a second support part extending outwards from an outer lower end of the annular protrusion part on a level plane with the first support part; and a third support part extending upright from an outer edge of the second support part, wherein the second extension of the extension part and an outer edge of the upper cover may be inserted between the annular protrusion part and the third support part and are seated onto the second support part.

Furthermore, a drain hole for draining water may be formed through the second support part.

The knob of the handle may include a first knob housing extending a predetermined length in a vertical direction, the first knob housing having a cylindrical shape; a second knob housing provided inside the first knob housing at a position spaced apart from the first knob housing by a predetermined distance, the second knob housing vertically extending a length shorter than the length of the first knob housing; and a third knob housing extending downwards from a lower end of the second knob housing towards a center of the control signal generator at a predetermined inclination angle.

The third knob housing may reflect light, emitted from the luminous unit provided in the control signal generator, and transmit the light to outside the handle.

In addition, a click protrusion may be provided on an inner surface of the upper cover, and a click dial may be formed on an outer surface of the extension part, the click dial engaging with the click protrusion.

As well, when the user pushes the rotary manipulation unit in a direction from the second position to the first position, the lift unit may move the rotary manipulation unit from the second position to the first position or from the first position to the second position using a cam mechanism.

The lift unit may include: an actuating bar coupled at a first end thereof to the rotary manipulation unit, with a cam guide protruding from one surface of the actuating bar; an elastic member coupled to a second end of the actuating bar; a cam shaft seated into the cam guide, the cam shaft being movable in a lateral direction; and a cam housing having a guide slot for receiving the cam shaft, the cam housing supporting the actuating bar and the elastic member therein, such that the actuating bar is movable upwards or downwards.

In another aspect, the present invention provides an air cleaner having a manipulator, wherein the manipulator comprises a rotary manipulation unit for controlling operation of the air cleaner by rotation thereof.

The rotary manipulation unit may include: a handle, having a knob and an extension part extending from a lower end of the knob in a circumferential direction; an upper cover for supporting the extension part of the handle to prevent the handle from being removed from a correct position thereof; a lower cover for covering a lower surface of the upper cover; and a control signal generator mounted to the lower cover to generate various control signals corresponding to the rotation of the handle for controlling the air cleaner.

The control signal generator may include: an encoder mounted to a PCB and connected to a rotating center of the handle to generate different control signals depending on angles at which the handle is rotated to; and at least one luminous unit to generate various colors of light.

The extension part of the handle may include: a first extension extending outwards from an outer surface of the knob in a horizontal direction; and a second extension extending from an outer edge of the first extension in a vertical direction, wherein the second extension may be inserted between the upper cover and an annular protrusion part, which protrudes from a perimeter of the lower cover in a vertical direction.

The lower cover may include: a first support part, on which the control signal generator is seated; the annular protrusion part protruding upright from an outer edge of the first support part; a second support part extending outwards from an outer lower end of the annular protrusion part on a level plane with the first support part; and a third support part extending upright from an outer edge of the second support part, wherein the second extension of the extension part and an outer edge of the upper cover may be inserted between the annular protrusion part and the third support part and are seated onto the second support part.

Furthermore, a drain hole for draining water may be formed through the second support part.

The knob of the handle may include: a first knob housing extending a predetermined length in a vertical direction, the first knob housing having a cylindrical shape; a second knob housing provided inside the first knob housing at a position spaced apart from the first knob housing by a predetermined distance, the second knob housing vertically extending a length shorter than the length of the first knob housing; and a third knob housing extending downwards from a lower end of the second knob housing towards a center of the control signal generator at a predetermined inclination angle.

The third knob housing may reflect light, emitted from the luminous unit provided in the control signal generator, and transmit the light to outside the handle.

In addition, a click protrusion may be provided on an inner surface of the upper cover, and a click dial may be formed on an outer surface of the extension part, the click dial engaging with the click protrusion.

In an air cleaner according to the present invention, a manipulator comprises a rotary encoder unit, which controls several functions of the air cleaner and which obviates the need for having several control buttons, thus being more convenient for a user.

Furthermore, because the single rotary manipulator is used in place of several control buttons, the present invention can solve the conventional problem in that the manipulator occupies a large area of the outer surface of the air cleaner. In addition, the present invention is constructed such that the encoder unit can be retracted into the air cleaner. Thus, after the use of the air cleaner (or the setting of the manipulator) is completed, the encoder unit is retracted into the air cleaner, thus improving the external appearance of the air cleaner.

Moreover, in the present invention, the structure of a handle of the manipulator and a lower cover is improved, so that water is prevented from permeating a PCB mounted in the lower cover. Thus, the encoder unit is prevented from malfunctioning due to water.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view showing the external shape of a conventional air cleaner;

FIG. **2** is of views showing the external shape of an air cleaner, according to an embodiment of the present invention;

FIGS. **3** and **4** are views showing the external shapes of air cleaners according to the embodiment of the present invention;

FIG. **5** is a view showing the construction of a manipulator of the air cleaner according to the present invention;

FIG. **6** is an exploded perspective view of a rotary manipulation unit of FIG. **5**;

FIG. **7** is a sectional view of the rotary manipulation unit of FIG. **6**;

FIG. **8** is a bottom perspective view of the assembled rotary manipulation unit having the elements of FIG. **7**;

FIG. **9** is a view showing an inner surface of an upper cover of FIG. **8**;

FIG. **10** is an exploded perspective view of a lift unit according to the embodiment of the present invention; and

FIG. **11** is of partial sectional views illustrating the operation principle of the manipulator of the air cleaner according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, an air cleaner according to a preferred embodiment of the present invention will be described in detail with reference to the attached drawings. The embodiment of the present invention pertains to only a manipulator for controlling the operation of the air cleaner, therefore detailed explanation of the method and the principle of air cleaning will be skipped.

FIG. **2** is of views showing the external shape of an air cleaner, according to an embodiment of the present invention. FIGS. **3** and **4** are views showing the external shapes of air cleaners according to the present invention, in which FIG. **3** illustrates a stand type air cleaner, and FIG. **4** illustrates a table type air cleaner.

As shown in FIGS. **2** through **4**, the air cleaner **100** has an inlet port **102**, through which air is drawn into the air cleaner **100**, and an outlet port **103**, through which purified air is discharged to the outside of the air cleaner **100**.

The inlet port **102** is formed in the front surface of the air cleaner **100**, and the outlet port **103** is formed in the upper surface of the air cleaner **100**. However, the location of the inlet port **102** or the outlet port **103** is not limited to the above-mentioned positions. According to the intended purposes, for example, according to whether the air cleaner **100** is a stand type or a table type, the location of the inlet port **102** or the outlet port **103** may be varied.

The air cleaner **100** includes a manipulator **200**. It is preferable that the manipulator **200** be an encoder unit, which is rotatable relative to the air cleaner **100** and is retractably extracted from the air cleaner **100**.

The manipulator **200** enables a user to control the operation of the air cleaner **100** according to his/her the desired intensions. Preferably, the manipulator **200** has a rotatable structure, such that the operation and functions of the air cleaner **100** are controlled depending on the rotation of the manipulator **200**.

Here, the manipulator **200** can be set such that various operation and functions of the air cleaner **100** are controlled by the manipulator **200**. For example, the operation of turning on/off the air cleaner **100**, cleaning intensity, cleaning duration, air discharge direction, or a cleaning mode such as a sandy dust removing mode, a dehumidifying mode, a humidifying mode, may be controlled by the manipulator **200**.

In this specification, the term "controlling the operation of the air cleaner" means that various operations and functions of the air cleaner are controlled.

Furthermore, the manipulator **200** is constructed such that it can be extracted from the outer surface of the air cleaner **100** so as to be retractable back into the air cleaner **100**.

In detail, under normal conditions, the manipulator **200** is in a state of being disposed inside a casing **101** of the air cleaner **100**. In this state, when the user pushes the manipulator **200** once to control the operation and functions of the air cleaner **100**, which has been in the retracted state, the manipulator **200** is extracted from the casing **101** of the air cleaner **100** to a predetermined distance, thus entering a state in which the user can rotate the manipulator **200** to control the air cleaner **100**. When the user again pushes the manipulator **200**, which has been extracted from the casing **101** of the air cleaner **100**, the manipulator **200** is returned to its original retracted state.

Here, the term "retraction of the manipulator **200** into the casing **101** of the air cleaner **100**" means that the manipulator **200** is inserted into the surface of the casing **101** to a predetermined depth such that one surface of the manipulator **200** is flush with the outer surface of the casing **101**. However, the present invention is not limited to this.

FIG. **5** is a view showing the construction of the manipulator according to the present invention. FIG. **6** is an exploded perspective view of a rotary manipulation unit of FIG. **5**. FIG. **7** is a sectional view of the rotary manipulation unit of FIG. **6**. FIG. **8** is a bottom perspective view of the assembled rotary manipulation unit having the elements of FIG. **7**. FIG. **9** is a view showing an inner surface of an upper cover of FIG. **8**.

The manipulator **200** will be explained in more detail with reference to FIGS. **5** through **9**.

As shown in FIG. **5**, the manipulator **200** includes the rotary manipulation unit **300** and a lift unit **400**.

The rotary manipulation unit **300** serves to control the operation of the air cleaner (**100**, refer to FIG. **2**) and has a rotatable structure. The rotary manipulation unit **300** is constructed such that it is extracted from the casing (**101**, refer to FIG. **2**) of the air cleaner **100** so as to be retractable into the casing **101**.

In other words, the rotary manipulation unit **300** is moved between a first position, at which the rotary manipulation unit **300** is in a state of being retracted into the casing **101** of the air cleaner **100**, and a second position, at which the rotary manipulation unit **300** is in a state of being extracted from the casing **101** to allow the user to manipulate the rotary manipulation unit **300**. Preferably, the first position to which the rotary manipulation unit **300** is retracted into the casing **101** of the air cleaner **100** is a position such that an upper surface of a knob **311** of the rotary manipulation unit **300** is flush with the outer surface of the casing **101** of the air cleaner **100**. Furthermore, it is preferable that the second position be a position at which the upper surface of the knob **311** is protruded from (or is exposed from) the outer surface of the casing **101** of the air cleaner **100** by a predetermined distance to allow the user to hold the rotary manipulation unit **300** and rotate it.

The lift unit **400** includes a mounting plate **403** and is supported in the air cleaner **100** by fastening the mounting plate **403** to the inner surface of the casing (**101**, refer to FIGS. **3**, **4** and **11**). An actuating bar **401** is provided in a housing **402** of the lift unit **400** so as to be movable upwards or downwards. The actuating bar **401** is coupled to the rotary manipulation unit **300**, thus moving the rotary manipulation unit **300** between the first position and the second position.

As stated above, the manipulator **200** of the present invention functions to control the air cleaner **100** and has the rotatable structure. Furthermore, the manipulator **200** is extracted into the casing **101** of the air cleaner **100** so as to be retractable into the casing **101**.

Referring to FIGS. **5** through **9**, the rotary manipulation unit **300** of the manipulator **200** which conducts the above-mentioned functions and operation includes a handle **310**, which enables the user to hold and rotate it. The handle **310** includes the knob **311**, which has a cylindrical shape, and an extension part **312**, which extends from the circumferential outer surface of the lower end of the knob **311** in a circumferential direction. The rotary manipulation unit **300** further includes an upper cover **320**, into which the extension part **312** is inserted to be prevented from being undesirably removed from the upper cover **320**, a lower cover **340** which covers the lower end of the upper cover, and a control signal generator **330** which is mounted to the lower cover **340**. The control signal generator **330** generates various control signals for controlling the air cleaner depending on the rotation of the handle **310** and transmits the signals to a control unit (not shown) of the air cleaner.

It is preferable that the knob **311** of the handle **310** have a cylindrical shape and thus ensure convenience of manipulation. However, in consideration of improvement in the external appearance of the air cleaner **100**, the knob **311** may have a polygonal cross-section. The knob **311** includes a first knob housing **311***a*, which vertically extends a predetermined length, and a second knob housing **311***b*, which is provided inside the first knob housing **311***a* at a position spaced apart from the first knob housing **311***a* by a predetermined distance. The second knob housing **311***b* vertically extends a length shorter than that of the first knob housing **311***a*. The knob **311** further includes a third knob housing **311***c*, which extends downwards from the lower end of the second knob housing **311***b* towards the center of the control signal generator **330** at a predetermined inclination angle. The extension part **312** of the handle **310** includes a first extension **312***a*, which horizontally extends outwards from the outer surface of the first knob housing **311***a*, and a second extension **312***b*, which vertically extends from the outer edge of the first extension **312***a*.

The upper cover **320** has a shape appropriate to cover the extension part **312** of the handle. The upper cover **320** is coupled to the lower cover **340**. The upper cover **320** includes a horizontal part **321**, which horizontally extends, and a vertical part **322**, which is bent from the edge of the horizontal part **321** in the vertical direction. An insert hole **324** is formed through the central portion of the horizontal part **321**. The knob **311** passes through the insert hole **324**.

The control signal generator **330** includes an encoder **332**, which is mounted to a PCB **331**, and at least one luminous unit, which emits various colors of light, and is preferably a light emitting diode **333** (hereinafter, referred to as 'LED'). Of course, another type of light emitting unit may be used as the luminous unit.

The encoder **332** functions to transmit input signals, generated depending to the rotation of the handle, to the PCB **331**, thus generating control signals. The encoder **332** is connected at the lower end thereof to the PCB **331**. The upper end of the encoder **332** has a cylindrical rotating shaft structure and thus is coupled to the rotational center of the handle **310**. The control signal generator **330** generates predetermined control signals depending on an angle, at which the handle is rotated, and thus controls the operation of the air cleaner **100**. In this embodiment, several LEDs **333** are provided on the PCB **331** to indicate the state of operation of the air cleaner **100**. Therefore, when various control signals are input depending on the rotation of the handle, the PCB **331** operates the LED or LEDs **333** corresponding to the input control signals such that the LED or LEDs **333** emit light. Here, the LEDs **333** have different colors, so that the control signals can be distinguished.

The control signal generator **330** is mounted to the central portion of the lower cover **340**. The lower cover **340** is coupled to the upper cover **320**. The handle **310** and the control signal generator **330** are supported by the lower cover **340** and the upper cover **320**, which are coupled to each other.

Three characteristics of the manipulator **200** according to the present invention having the above-mentioned construction will now be discussed.

A first characteristic of the manipulator **200** according to the present invention is that even if the air cleaner is placed in the horizontal direction but not placed in the vertical direction, that is, even if the manipulator **200** is oriented in the horizontal direction, the PCB can be prevented from being damaged by water seepage. That is, the manipulator **200** is characterized in that the PCB **331** can be insulated from the outside by the extension part **312** of the handle **310** and the lower cover **340**.

To achieve the above-mentioned purpose, the extension part **312** has the first extension **312***a*, which horizontally extends outwards from the outer surface of the first knob housing **311***a* of the handle, and the second extension **312***b*, which vertically extends from the outer edge of the first extension **312***a*.

Furthermore, the lower cover **340** includes a first support part **341**, onto which the control signal generator **330** is seated, and an annular protrusion part **342**, which protrudes upright from the outer edge of the first support part **341**. The lower cover **340** further includes a second support part **343**, which extends outwards from the outer lower end of the annular protrusion part **342** on a level plane with the first support part **341**, and a third support part **344**, which extends upright from the outer edge of the second support part **343**. The second extension **321***b* of the extension part and the vertical part **322** of the upper cover are inserted between the annular protrusion part **342** and the third support part **344** and are thus disposed on the second support part **343**. In addition, a drain hole **345** is formed through the second support part **343**. Thus, water, which flows on the outer surfaces of the first knob housing **311***a*, the first extension **312***a* and the second extension **312***b*, is discharged to the outside the manipulator.

A second characteristic of the manipulator **200** according to the present invention is that light generated from the LEDs of the control signal generator **330** is emitted to the outside through the handle **310**, allowing for improvements in the external appearance of the air cleaner and indicating the state of operation of the air cleaner.

To achieve the above purpose, the third knob housing **311***c*, which is provided inside the handle **310**, is inclined downwards towards the center or the control signal generator **330**, as stated above.

In detail, the control signal generator **330** is placed below the third knob housing **311***c*. Light emitted from the LEDs **333** of the control signal generator **330** is reflected by the third knob housing **311***c* and is thus dispersed towards the entire area of the outer surface of the handle. The dispersed light is transmitted to the outside of the handle through various light transmission paths. That is, as shown in FIG. **7**, light may be emitted to outside the handle via space between the first knob housing **311***a* and the second knob housing **311***b*. Some light may be emitted to outside the handle through other light transmission space.

In further detail, the third knob housing **311***c* functions to disperse light in various directions emitted from the LEDs. Furthermore, it is preferable that the first through third knob housings and the other elements provided in the handle be coated with material having relatively high reflectability. With regard to the handle, a portion, which connects the first knob housing **311***a* and the second knob housing **311***b* to each other, or other portions, through which light is transmitted to the outside of the handle, are preferably made of transparent material.

A third characteristic of the manipulator **200** according to the present invention is that it is constructed such that the user can feel a clicking vibration when rotating the handle **310**.

To achieve this purpose, a click protrusion **323** is provided on the inner surface of the horizontal part **321** of the upper cover **320**. A click dial **312***c*, which contacts the click protrusion **323** to provide a clicking vibration, is formed on the outer surface of the first extension **321***a* of the handle.

Of course, the encoder **332** itself has a structure for providing a clicking vibration when rotating. However, because the handle **310** has a diameter larger than that of the rotating shaft of the encoder **332**, when the user holds and rotates the handle **310**, the clicking vibration may deteriorate. To prevent this, the present invention has the additional click protrusion **323** and click dial **312***c*, thus improving the clicking vibration.

Here, the number of graduations on the click dial **321***c* or the interval between graduations can be set depending on the number of kinds of operations or functions of the air cleaner that is indicated by the manipulator **200**.

Furthermore, the click protrusion **323** may be provided on the inner surface of the vertical part **322**. In this case, the click dial **312***c* is preferably provided on the outer surface of the second extension **312***b*.

FIG. **10** is an exploded perspective view of the lift unit according to the embodiment of the present invention. FIG. **11** is partial sectional view illustrating the operating principle of the manipulator of the air cleaner according to the embodiment of the present invention.

The lift unit **400** will be explained with reference to FIG. **10**. The lift unit **400** includes an actuating bar **401**, a coupling plate **403**, an elastic member **405**, a cam shaft **406** and a cam housing **402**, containing these elements therein. The actuating bar **401** is provided in the cam housing **402** so as to be movable upwards or downwards. Here, the term "upwards or downwards" means a direction, in which the rotary manipulation unit (**300**, refer to FIG. **6**) is extracted from or retracted into the casing of the air cleaner. Therefore, the rotary manipulation unit **300** is coupled to a first end of the actuating bar **401**. The actuating bar **401** is moved in the cam housing **402** using cam mechanism. For this, a cam guide **404** which guides a cam shaft **406** protrudes from one surface of the actuating bar **401**.

The elastic member **405** is coupled to a second end of the actuating bar **401**. A typical spring may be used as the elastic member **405**. The elastic member **405** provides elastic force to the rotary manipulation unit **300** such that the rotary manipulation unit **300** is biased to the outside of the casing **101** of the air cleaner **100**.

The cam housing **402** contains the actuating bar **401**, the elastic member **405** and the cam shaft **406** therein. A guide slot **407** is formed in one surface of the cam housing **402**, so that the cam shaft **406** is movable in the lateral direction along the guide slot **407**.

The operative principle of the manipulator according to the embodiment of the present invention will be explained with reference to FIGS. **10** and **11**.

As shown in FIG. **11**, when the user pushes the knob **311** of the rotary manipulation unit **300**, the lift unit **400** moves the rotary manipulation unit **300** from the state A to the state B or from the state B to the state A using the cam mechanism. Here, the term "pushing the rotary manipulation unit **300**" means that the user pushes the rotary manipulation unit **300** downwards once and then releases it, so that a predetermined pressure is applied for a predetermined time to the rotary manipulation unit **300** before being released.

In the state A, the rotary manipulation unit **300** is disposed at a first position. The state A indicates a normal condition operating state in which the user does not use the rotary manipulation unit **300**. In that state, the elastic member **405** is in a state of having been compressed by the downward movement of the actuating bar **401**. The cam shaft **406** is in a state of having been seated into an upper depression of the cam guide **404**, so that the actuating bar **401** maintains the state of having been moved downwards.

From the state A, when the user pushes the knob **311** of the rotary manipulation unit **300**, downward force is applied to the actuating bar **401** for a predetermined time, so that the actuating bar **401** is further moved downwards by the downward force and thus further compresses the elastic member **405**. At this time, because the cam shaft **406**, which has been seated in the upper depression of the cam guide **404**, is movable only in the lateral direction (due to the guide slot **407**, refer to FIG. **10**), the cam shaft **406** is moved to the left by a corresponding protrusion of the cam guide **404**, as the actuating bar **401** is moved downwards. Thereafter, when the downward force is removed, the actuating bar **401** is moved upwards by the elastic force of the elastic member **405**. The cam shaft **406** is moved in the direction ① by the upward movement of the actuating bar **401** and then is seated into a lower depression of the cam guide **404**. Thus, the rotary manipulation unit **300** is extracted outwards from the casing **101** of the air cleaner **100**. As a result, the rotary manipulation unit **300** enters the state B and, in other words, is disposed at the second position to allow the user to hold and rotate the rotary manipulation unit **300**.

In the state B, when the user pushes the knob **311** of the rotary manipulation unit **300** downwards again, downward force is applied to the actuating bar **401** for a predetermined time. The actuating bar **401** is moved downwards by the downward force and thus compresses the elastic member **405**. The cam shaft **405**, which has been seated in the lower depression of the cam guide **404**, is moved in the direction ② by a corresponding protrusion of the cam guide **404**, as the actuating bar **401** is moved downwards. Thereafter, when the downward force is removed, the cam shaft **405** is seated into the upper depression of the cam guide **404** and enters into the state A.

Although the preferred embodiment of the present invention has been disclosed for illustrative purposes, the present invention is not limited to the embodiment. Furthermore, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims. Therefore, these modifications, additions and substitutions must be regarded as falling within the bounds of the present invention.

The invention claimed is:

1. An air cleaner having a manipulator, wherein the manipulator comprises:

a rotary manipulation unit provided so as to be movable between a first position, at which the rotary manipulation unit is retracted into a casing of the air cleaner, and a second position, at which the rotary manipulation unit

is extracted from the casing of the air cleaner to enable a user to manipulate the rotary manipulation unit, wherein when the rotary manipulation unit is disposed at the second position, the rotary manipulation unit is allowed to be rotated by the manipulation of the user to control operation of the air cleaner; and

a lift unit supportably installed in the air cleaner to move the rotary manipulation unit between the first position and the second position,

wherein the rotary manipulation unit comprises:

a handle which is installed rotatably and

an encoder mounted to a PCB and connected to a rotating center of the handle to generate different control signals depending on angles at which the handle is rotated to.

2. The air cleaner according to claim **1**, wherein the rotary manipulation unit comprises:

a handle, having a knob and an extension part extending from a lower end of the knob in a circumferential direction;

an upper cover for supporting the extension part of the handle to prevent the handle from being removed from a correct position thereof;

a lower cover for covering a lower surface of the upper cover; and

a control signal generator mounted to the lower cover to generate various control signals corresponding to the rotation of the handle for controlling the air cleaner.

3. The air cleaner according to claim **2**, wherein the control signal generator comprises:

at least one luminous unit to generate various colors of light.

4. The air cleaner according to claim **2**, wherein the extension part of the handle comprises:

a first extension extending outwards from an outer surface of the knob in a horizontal direction; and

a second extension extending from an outer edge of the first extension in a vertical direction, wherein

the second extension is inserted between the upper cover and an annular protrusion part, which protrudes from a perimeter of the lower cover in a vertical direction.

5. The air cleaner according to claim **4**, wherein the lower cover comprises:

a first support part, on which the control signal generator is seated;

the annular protrusion part protruding upright from an outer edge of the first support part;

a second support part extending outwards from an outer lower end of the annular protrusion part on a level plane with the first support part; and

a third support part extending upright from an outer edge of the second support part, wherein

the second extension of the extension part and an outer edge of the upper cover are inserted between the annular protrusion part and the third support part and are seated onto the second support part.

6. The air cleaner according to claim **5**, wherein a drain hole for draining water is formed through the second support part.

7. The air cleaner according to claim **2**, wherein the knob of the handle comprises:

a first knob housing extending a predetermined length in a vertical direction, the first knob housing having a cylindrical shape;

a second knob housing provided inside the first knob housing at a position spaced apart from the first knob housing by a predetermined distance, the second knob housing vertically extending a length shorter than the length of the first knob housing; and

a third knob housing extending downwards from a lower end of the second knob housing towards a center of the control signal generator at a predetermined inclination angle.

8. The air cleaner according to claim **7**, wherein the third knob housing reflects light, emitted from the luminous unit provided in the control signal generator, and transmits the light to outside the handle.

9. The air cleaner according to claim **2**, wherein a click protrusion is provided on an inner surface of the upper cover, and a click dial is formed on an outer surface of the extension part, the click dial engaging with the click protrusion.

10. The air cleaner according to claim **1**, wherein when the user pushes the rotary manipulation unit in a direction from the second position to the first position, the lift unit moves the rotary manipulation unit from the second position to the first position or from the first position to the second position using a cam mechanism.

11. The air cleaner according to claim **1**, wherein the lift unit comprises:

an actuating bar coupled at a first end thereof to the rotary manipulation unit, with a cam guide protruding from one surface of the actuating bar;

an elastic member coupled to a second end of the actuating bar;

a cam shaft seated into the cam guide, the cam shaft being movable in a lateral direction; and

a cam housing having a guide slot for receiving the cam shaft, the cam housing supporting the actuating bar and the elastic member therein, such that the actuating bar is movable upwards or downwards.

12. The air cleaner according to claim **1**, wherein the rotary manipulation unit comprises:

a handle, having a knob and an extension part extending from a lower end of the knob in a circumferential direction;

an upper cover for supporting the extension part of the handle to prevent the handle from being removed from a correct position thereof;

a lower cover for covering a lower surface of the upper cover; and

a control signal generator mounted to the lower cover to generate various control signals corresponding to the rotation of the handle for controlling the air cleaner.

13. The air cleaner according to claim **12**, wherein the control signal generator comprises:

an encoder mounted to a PCB and connected to a rotating center of the handle to generate different control signals depending on angles at which the handle is rotated to; and

at least one luminous unit to generate various colors of light.

14. The air cleaner according to claim **12**, wherein the extension part of the handle comprises:

a first extension extending outwards from an outer surface of the knob in a horizontal direction; and

a second extension extending from an outer edge of the first extension in a vertical direction, wherein

the second extension is inserted between the upper cover and an annular protrusion part, which protrudes from a perimeter of the lower cover in a vertical direction.

15. The air cleaner according to claim **14**, wherein the lower cover comprises:

a first support part, on which the control signal generator is seated;

the annular protrusion part protruding upright from an outer edge of the first support part;

a second support part extending outwards from an outer lower end of the annular protrusion part on a level plane with the first support part; and

a third support part extending upright from an outer edge of the second support part, wherein

the second extension of the extension part and an outer edge of the upper cover are inserted between the annular protrusion part and the third support part and are seated onto the second support part.

16. The air cleaner according to claim **15**, wherein a drain hole for draining water is formed through the second support part.

17. The air cleaner according to claim **12**, wherein the knob of the handle comprises:

a first knob housing extending a predetermined length in a vertical direction, the first knob housing having a cylindrical shape;

a second knob housing provided inside the first knob housing at a position spaced apart from the first knob housing by a predetermined distance, the second knob housing vertically extending a length shorter than the length of the first knob housing; and

a third knob housing extending downwards from a lower end of the second knob housing towards a center of the control signal generator at a predetermined inclination angle.

18. The air cleaner according to claim **17**, wherein the third knob housing reflects light, emitted from the luminous unit provided in the control signal generator, and transmits the light to outside the handle.

19. The air cleaner according to claim **12**, wherein a click protrusion is provided on an inner surface of the upper cover, and a click dial is formed on an outer surface of the extension part, the click dial engaging with the click protrusion.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,551,234 B2
APPLICATION NO. : 12/672543
DATED : October 8, 2013
INVENTOR(S) : Kim et al.

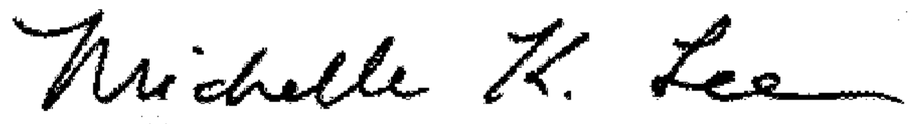
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page:

The first or sole Notice should read --

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 895 days.

Signed and Sealed this
Fifteenth Day of September, 2015



Michelle K. Lee
Director of the United States Patent and Trademark Office